



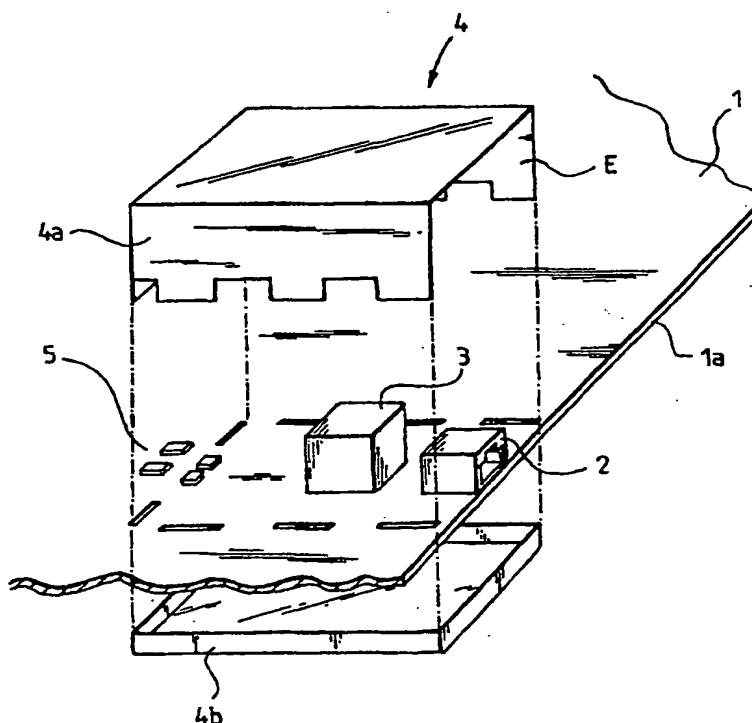
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>H04B 15/00, 3/28, H05K 9/00</b>	<b>A1</b>	(11) International Publication Number: <b>WO 95/06370</b> (43) International Publication Date: <b>2 March 1995 (02.03.95)</b>
<p>(21) International Application Number: <b>PCT/FI94/00362</b></p> <p>(22) International Filing Date: <b>19 August 1994 (19.08.94)</b></p> <p>(30) Priority Data: <b>933692</b>                      <b>20 August 1993 (20.08.93)</b>                      <b>FI</b></p> <p>(71) Applicant (for all designated States except US): <b>NOKIA TELECOMMUNICATIONS OY [FI/FI]; Mäkkylän puisto 1, FIN-02600 Espoo (FI).</b></p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): <b>JOHANSSON, Kaj [FI/FI]; Siuntionkatu 4 B 10, FIN-00510 Helsinki (FI).</b></p> <p>(74) Agent: <b>OY KOLSTER AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).</b></p>	<p>(81) Designated States: <b>AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LT, LU, LV, MD, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD).</b></p> <p><b>Published</b> <i>With international search report.</i></p>	

(54) Title: AN ARRANGEMENT FOR FILTERING EQUIPMENT-INDUCED RADIO-FREQUENCY INTERFERENCE

## (57) Abstract

The invention relates to an arrangement for filtering equipment-induced radio-frequency interference in a balanced signal connector (2) of equipment, e.g. a telephone connector, provided with a separation device (3) such as a signal transformer, an opto-coupler or the like. The balanced signal connector (2) with a separation device (3) is enveloped in an electrically conductive shielding (4), whereby the filtering is effected on the low-voltage side of the equipment.



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An arrangement for filtering equipment-induced radio-frequency interference

5           The present invention relates to an arrangement for filtering equipment-induced radio-frequency interference in a balanced signal connector of equipment, e.g. a telephone connector, provided with a separation device such as a signal transformer, an  
10           opto-coupler or the like. The purpose is to prevent radio-frequency interference from being transmitted from the equipment to the balanced signal line.

          The common practice for filtering equipment-induced radio-frequency interference at a balanced unprotected signal line provided with a separation component has been based on the use of series elements,  
15           such as rod chokes, ferrite pearls, ferrite tubes and common mode chokes, because balanced signal lines are subject to overvoltage requirements which prevent implementation of the filtering by using components,  
20           such as capacitors, connected to earth or chassis.

          By connecting several series elements in series or passing the signal to be filtered several times through a ferrite tube, for instance, the serial impedance can be increased, but in practice it is not  
25           feasible to employ more than three series elements, because even though the serial impedance is further increased by similar steps, the attenuation in decibels is not significantly increased.

          With the increase of the number of series elements, the area occupied by filtering on the PCB also  
30           increases, with the result that the increase of the area causes better coupling of radio-frequency interference and thereby impairment of filtering efficiency.

          It is an object of the present invention to  
35           remove the above drawbacks. This is achieved with an

arrangement according to the invention, which is characterized in that the balanced signal connector with the associated separation device is enveloped in an electrically conductive shielding, whereby the filtering is effected on the low-voltage side of the equipment.

The solution according to the invention allows better filtering than heretofore, and furthermore it is possible to employ components that need not withstand high voltages and currents and are thus more advantageous.

The shielding may be effected either with a separate shield or by constructing the actual equipment chassis to provide the shielding.

The filtering can be effected by way of series components or filtering to the equipment chassis or to earth, or combinations of these.

The invention will now be explained in greater detail by means of one exemplary embodiment with reference to the accompanying drawing illustrating the arrangement of the invention as a simplified schematic drawing.

The drawing shows a PCB 1 of equipment which may be a network terminal or a data modem. The PCB 1 has a balanced signal connector 2 (e.g. a telephone connector). The connector 2 is provided with a separation component 3, such as a signal transformer, an opto-coupler or the like, for implementing the galvanic separation of the connector 2 on the low-voltage side of the equipment. The connector 2 may also incorporate protection components not shown in the drawing.

The balanced signal connector 2 with separation component 3 and possible protection components is enveloped in a shielding 4, which in this case is composed of two shield parts 4a and 4b disposed on both

sides of the PCB 1 which comprises the signal connector 2 and the separation component 3. On account of the shielding 4, the filtering of interference can be effected on the low-voltage side of the equipment within and/or outside the shielding, for example with filtering components 5 which are shown in the drawing and which may be components designed for low voltages and currents, connected in series in regard to the signal, to earth or chassis, or combinations of the above. In a complete installation the open edge E of the shield part 4a and the edge 1a of the PCB lie against the equipment chassis (not shown), thus closing the shield.

The invention has been disclosed above by means of one preferred exemplary embodiment only. Those skilled in the art can implement its details in several alternative ways within the scope of the appended claims.

## Claims:

5 1. An arrangement for filtering equipment-induced radio-frequency interference in a balanced signal connector (2) of equipment, e.g. a telephone connector, provided with a separation device (3) such as a signal transformer, an opto-coupler or the like, c h a r a c t e r i z e d in that the balanced signal connector (2) with the associated separation device (3) 10 is enveloped in an electrically conductive shielding (4), whereby the filtering is effected on the low-voltage side of the equipment.

15 2. An arrangement as claimed in claim 1, c h a r a c t e r i z e d in that the shielding (4) is provided by a separate shield composed of two shield parts (4a, 4b) disposed on both sides of a PCB (1) which comprises the signal connector (2) and the separation component (3).

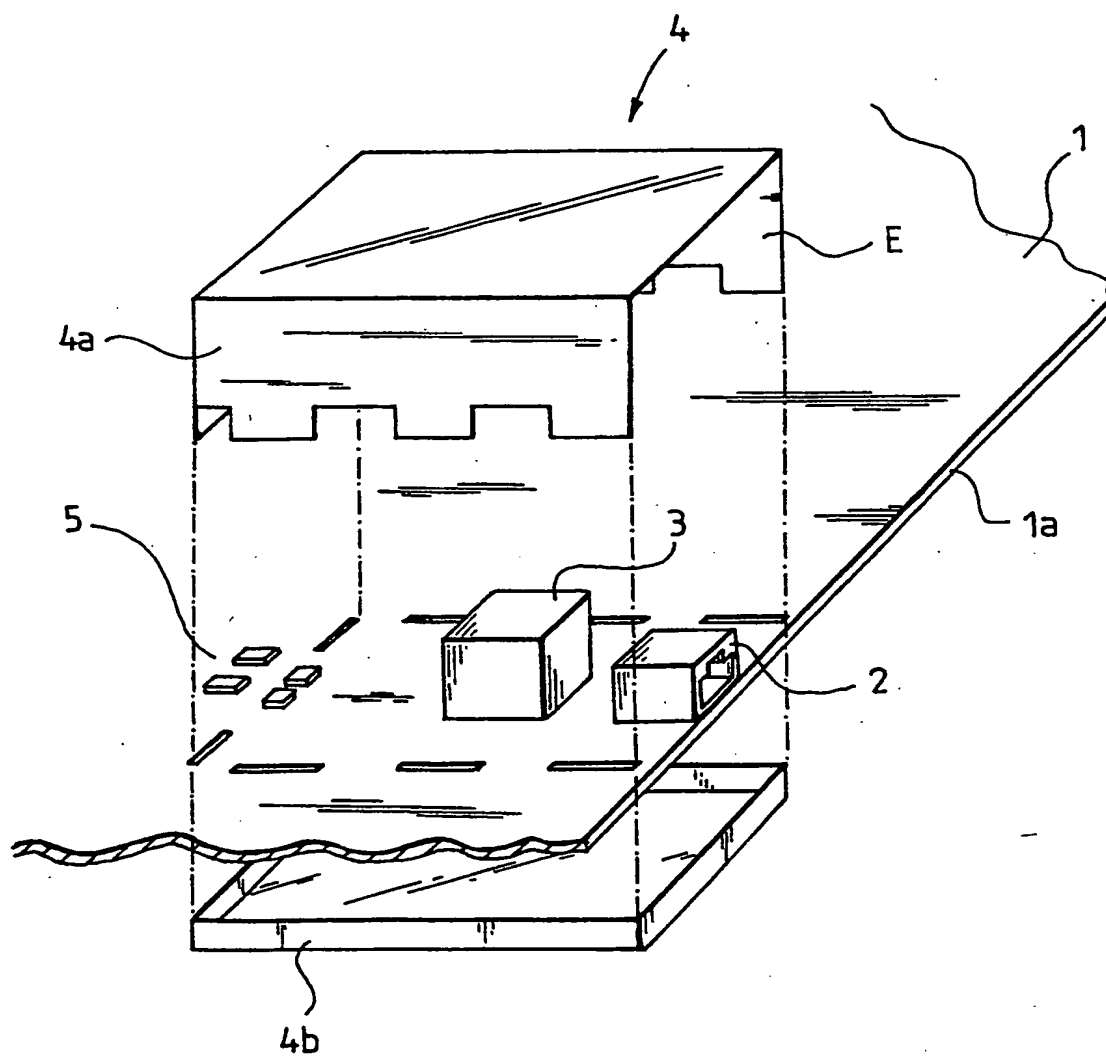
20 3. An arrangement as claimed in claim 1, c h a r a c t e r i z e d in that the shielding (4) is provided in part or entirely by the actual equipment chassis.

25 4. An arrangement as claimed in any one of the preceding claims, c h a r a c t e r i z e d in that the filtering is effected by way of series components (5).

30 5. An arrangement as claimed in any one of the preceding claims, c h a r a c t e r i z e d in that the filtering is effected to the equipment chassis.

6. An arrangement as claimed in any one of the preceding claims, c h a r a c t e r i z e d in that the filtering is effected to earth.

1/1



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 94/00362

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04B 15/00, H04B 3/28, H05K 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04B, H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: WPI, CLAIMS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 5165055 (A. METSLER), 17 November 1992 (17.11.92), column 5, line 67 - column 6, line 2, figures 1,3, abstract	1-2
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A	US, A, 4504705 (B. PILLOUD), 12 March 1985 (12.03.85), abstract	1
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Date of the actual completion of the international search

8 December 1994

Date of mailing of the international search report

12-12-1994

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